

## **APPROPRIATENESS OF TRACER-GAS-MIXTURE FOR USING IN RE-COMPLETED CAVERN TO LOCATE TECHNICAL AND GEOLOGICAL PATHES TO THE SURFACE**

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### **Abstract**

The proof of the technical integrity of a cavern starts already during the drilling stage of the cavern well. For this the technical tightness within the range of the final cemented casing is tested after the final well depth is reached and before the leaching process is started. Here the fundamental approaches of the examination of the tightness vary. At first this examination depends on the blanket medium used. Depending on the applied blanket medium a hydraulic and accordingly a pneumatic proving of the tightness is accomplished, whereby the trend of the pneumatic tightness test shows a tendentious increase. The primary objective of this examination is to prove that no leakage will occur during the leaching process under the maximum allowable leaching pressure. Here it becomes evident that the examination depends on the maximum achievable leaching pressure but in this connection no sufficient statement about the technical integrity for the later intended gas storage operation considering the calculated maximum storage pressures can be made.

A second testing of the technical tightness (main tightness test) is accomplished after the completion of the leaching process. Here the focus is the task and accordingly the primary objective - proof of the technical integrity of the final cemented casing within the range of the casing shoe. In connection with this examination the pneumatic tightness of the composite casing shoe-cement-rock must be verified. In order to make a statement about the actual leakages or the gas losses a procedure must be applied that allows the provision of quantitative information about the leakage rates achieved and the associated error estimation. Here the evaluation of the technically pneumatic tightness is specified relating to tightness criteria. The tightness criterion depends on the construction of the cavern and the boundary conditions of the thermodynamic system.

After finishing the cavern completion the final installation is tested again. For this the final installation is tested considering the maximum achievable pressure during the gas storage operation. The objective of this examination is the proof of the pneumatic tightness of the cavern well installation. In this case no leakage rate is detected.

The above mentioned test arrangement is applied in connection with new build caverns.

For cavern wells which were in operation or recently completed and which possess technical complications with respect to the gas tightness (irregular annulus activities) it is vitally important to firstly localize and identify the leakages so that an efficient repair program can be specified. Since these caverns were operated with hydrocarbons of different composition it is not possible to localize the leakage only on the basis of the pressure development and simple gas analysis. For this the application of indication gases which can be detected even after the completion of the tightness tests is to the best

advantage. By detecting indication gases further technical and geological leakages can be identified separately.

In the present technical paper the application of tracer gas mixture is examined. The test relevant thermodynamic processes during the mixture procedure between the test gas and the tracer gas under test conditions are specified by means of analytic approaches as well as numeric investigations. Furthermore new test technologies as well as possible applications of such tests are investigated.

**Key words:** Keywords: Tightness Tests; Tracer Gas; technical untightness; geological untightness; Test method; Cavern recompletion.

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